

REMARKS

Claims 1-12 and 14-16 are pending.

Claims 1-10 and 14 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Tani et al. (JP 10-231317) in view of Badley et al. (US 5,576,263).

Claims 1-6 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Koehn et al. (Abstr. ACS, 1997) in view of Badley et al. (US 5,576,263). Applicants respectfully traverse these rejections.

Applicants again urge that the copolymerization of olefins is not straightforward (as acknowledged by the Examiner in the Office action of August 5, 2003) and that use of the present catalyst system for such copolymerization would not have been obvious. As further evidence thereof, applicants enclose the article *Constrained Geometry Chromium Catalysts for Olefin Polymerization* (Liang et al., Organometallics, 1996) which explains that a homogeneous monocyclopentadienyl chromium complex is able to dimerize higher alpha-olefins and to polymerize ethylene, but is not able to copolymerize olefins (page 5285, second paragraph). That article also mentions that most homogeneous chromium catalysts do not copolymerize olefins (page 5285, third paragraph). Such negative teaching is evidence of nonobviousness. See MPEP 2145 X. D. (“It is improper to combine references where the references teach away from their combination.”; “...proceeding contrary to accepted wisdom in the art is evidence of nonobviousness.”).

Furthermore, copolymerization with the complexes of the instant invention shows

another advantage: the molecular weight is not reduced when comonomers are incorporated. In many polymerizations in the presence of single site catalysts, switching from homo- to copolymerizations results in a significant drop of the molecular weight of the polymer. Koehn et al. teaches that the polymerization of hexene leads only to trimerization products. (Tani et al. teaches nothing regarding polymerization of higher olefins.) One of ordinary skill in the art would therefore have expected that the incorporation of comonomers, if at all possible, would at least lead to a drop in

molecular weight. With the catalyst systems of the present invention, however, the molecular weight does not drop, but instead rises when comonomer is incorporated.

See Table 2, page 25 and 26, comparing examples 25 and 37. In both examples, the same chromium complex was used with MAO as a cocatalyst. In example 25, no comonomer was used to give a homopolymer with an Eta-value of 1.04 dl/g. In example 37, a copolymer with an Eta-value of 3.87 dl/g was obtained. Since the Eta-value is proportional to the molecular weight (see enclosed Mark-Howink-Plot, labeled D2), the polymer obtained in the presence of the comonomer has a higher molecular weight. The same trend is also observed for examples 34 (no comonomer) and 38 (with comonomer) and for examples 26 (with comonomer) and 27 (no comonomer), although in the last two examples (26 and 27) the cocatalyst ratios are not exactly identically. Badley et al. only describes copolymerizations in general and the examples are restricted to ethylene homopolymerizations. Therefore, neither in the description, nor in the examples does Badley et al. disclose any effect of the comonomer

incorporation on the molecular weight of the polymer.

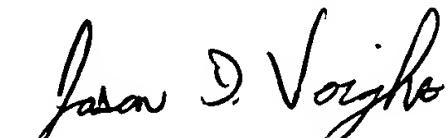
Applicants further urge that it would not have been obvious to employ the complex in conjunction with a support (claim 9), and submit that the Examiner has relied on impermissible hindsight to reach a contrary conclusion. Chromium is an early transition metal favoring bonding to electronegative, hard ligands (see enclosed *Transition Metal Chemistry*, Gerloch et al., 1994, p. 175). Since the OH-groups on the silica surface are more electronegative than the NR<sub>3</sub>-groups in the triazahexane ligand, one could have presumed that the triazahexane ligand might be replaced by the oxygen groups on the silica. That this is not the case might be due to the chelating effect of the triazahexane ligand. However, this was not predictable.

*No, I don't think so*

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Respectfully submitted,

KEIL & WEINKAUF

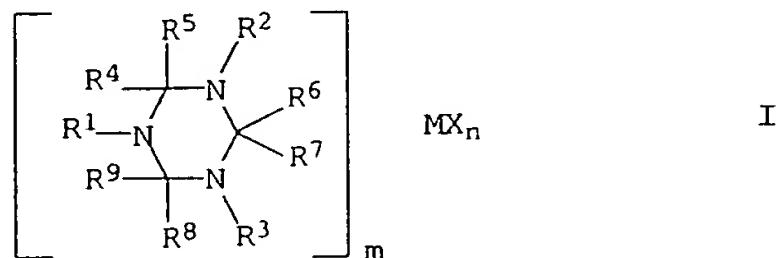


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**COMPLETE LISTING OF ALL CLAIMS IN THE APPLICATION**

1. (previously presented) A process for copolymerizing ethylene or propylene with one another or with other olefinically unsaturated compounds, which comprises carrying out in the polymerization in the presence of a catalyst system which comprises the following components:
  - A) a complex of a transition metal with one or two substituted or unsubstituted 1,3,5-triazacyclohexane ligands, and
  - B) if desired one or more activator compounds.
2. (previously presented) A process for copolymerizing ethylene or propylene with one another or with other olefinically unsaturated compounds at from 20 to 300°C under pressures from 5 to 4000 bar, which comprises the following steps:
  - a) contacting a complex of a transition metal with one or two substituted or unsubstituted 1,3,5-triazacyclohexane ligands (A) with at least one activator compound (B),
  - b) contacting the reaction product from step (a) with the olefinically unsaturated compounds under polymerization conditions.
3. (previously presented) A process as claimed in claim 1, wherein the component (A) is a compound of the formula I

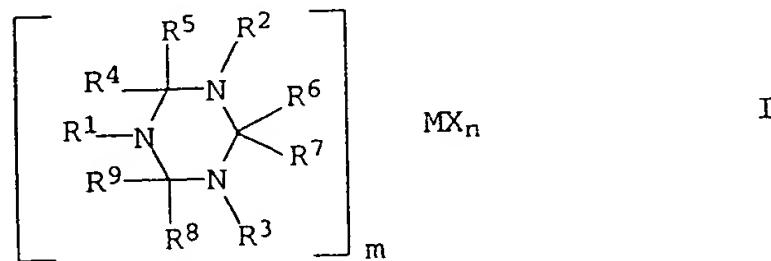


in which:

M is a transition metal of groups 4 to 12 of the Periodic Table,  
R<sup>1</sup>-R<sup>9</sup> are hydrogen or organosilicon or organic substituents having from 1 to 30  
C atoms, it being possible for two geminal or vicinal radicals R<sup>1</sup> to R<sup>9</sup>  
radicals also be connected to form a 5- or 6-membered ring, and it being  
possible, when m is 2, for an R<sup>1</sup>-R<sup>9</sup> radical of in each case one  
triazacyclohexane ring to form together with a substituents on the other  
triazacyclohexane ring a bridge between the two rings,  
X is fluorine, chlorine, bromine, iodine, hydrogen, C<sub>1</sub>-C<sub>10</sub>-alkyl, C<sub>6</sub>-C<sub>15</sub>-aryl  
or alkylaryl having from 1 to 10 C atoms in the alkyl radical and from 6 to  
20 C atoms in the aryl radical, trifluoroacetate, BF<sub>4</sub><sup>-</sup>, PF<sub>6</sub><sup>-</sup> or bulky  
noncoordinating anions,  
m is 1 or 2,  
n is a number from 1 to 4 which corresponds to the oxidation state of the  
transition metal M.

4. (currently amended) A process as claimed in ~~claim 1~~ claim 3, wherein M is a transition metal of group 6 of the Periodic Table.
5. (previously presented) A process as claimed in claim 1, wherein mixtures of ethylene with C<sub>3</sub>-C<sub>8</sub>-a-olefins are employed as monomers.
6. (previously presented) A process as claimed in claim 1, wherein an aluminoxane is employed as activator compound (B).

7. (previously presented) A process as claimed in claim 1, wherein borane or borate having at least 2 substituted aryl radicals is employed as the activator compound (B).
8. (previously presented) A process as claimed in claim 3, wherein at least one of the radicals  $R^1$ ,  $R^2$  or  $R^3$  is different from the other radicals in this group.
9. (previously presented) A catalyst for polymerizing olefins, comprising at least one transition metal complex (A) as defined in claim 1 and a support material and, if desired, one or more activator compounds (B).
10. (previously presented) A process for polymerizing or copolymerizing olefins wherein the polymerization or copolymerization is carried out in the presence of a catalyst as claimed in claim 9.
11. (previously presented) A transition metal complex of the formula I



in which:

M is a transition metal of groups 4 to 12 of the Periodic Table,  
 $R^1-R^9$  are hydrogen or organosilicon or organic substituents having from 1 to 30 C atoms, it being possible for two geminal or vicinal radicals  $R^1$  to  $R^9$

radicals also be connected to form a 5- or 6-membered ring, and it being possible, when m is 2, for an R<sup>1</sup>-R<sup>9</sup> radical of in each case one triazacyclohexane ring to form together with a substituents on the other triazacyclohexane ring a bridge between the two rings,

X is fluorine, chlorine, bromine, iodine, hydrogen, C<sub>1</sub>-C<sub>10</sub>-alkyl, C<sub>6</sub>-C<sub>15</sub>-aryl or alkylaryl having from 1 to 10 C atoms in the alkyl radical and from 6 to 20 C atoms in the aryl radical, trifluoroacetate, BF<sub>4</sub>-, PF<sub>6</sub>- or bulky noncoordinating anions,

m is 1 or 2,

n is a number from 1 to 4 which corresponds to the oxidation state of the transition metal M,

wherein at least one of the radicals R<sup>1</sup>, R<sup>2</sup> or R<sup>3</sup> is different from the other radicals in this group.

12. (previously presented) A transition metal complex of the formula I as defined in claim 11, wherein m is 2 and one radical R<sup>1</sup>-R<sup>9</sup> of one triazacyclohexane ring together with one of these substituents of the other triazacyclohexane ring forms a bridge between the two rings.

13. (canceled)

14. (previously presented) A process as claimed in claim 3, wherein m is 2 and one radical R<sup>1</sup>-R<sup>9</sup> of one triazacyclohexane ring together with one of these substituents of the other triazacyclohexane ring forms a bridge between the two

rings.

15. (new) A process as claimed in claim 1, wherein the transition metal is selected from group 6 of the Periodic Table.
16. (new) A process as claimed in claim 1, wherein the transition metal is titanium, zirconium, hafnium, vanadium, chromium, molybdenum, tungsten, manganese, iron, rhodium or nickel.